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Abstract

Mark Heller, in "Temporal Parts of Four-Dimensional Objects," argues for an ontology of objects with four dimensions. He thinks that by arguing for an ontology that incorporates the temporal dimension he is able to deny some distasteful propositions that the proponent of a three-dimensional ontology must choose between to avoid contradicting themselves as they attempt to develop an account of how objects are able to persist, as the same objects, through change. This is a view that I find attractive, but with some reservation. This paper will explain Heller's fourth-dimensionalism by looking at an argument he brings up against three-dimensionalism. I will reply to his handling of the argument by raising two important areas of clarification that the four-dimensionalist must address. After this, I will bring up a possible solution to the areas needing clarification by suggesting an ontology that includes an essential part alongside temporal parts.

General Definitions

"A four-dimensional object is the material content of a filled region of space-time. A spatiotemporal part of such an object is the material content of a subregion of the space-time occupied by the whole." (Ibid, 497) Heller points out that for any region that is not filled by space-time, then there is no physical object. For a region to be full, he says, is for it to contain no empty subregions (Ibid, 496). Heller thinks that we should expect temporal characteristics to share some traits of spatial characteristics, such as precise boundaries. "A spatiotemporal part is not a set or a process or a way something is at a place and time. It, like the object it is a part of, is a hunk of matter." (Ibid, 497) This means that spatiotemporal parts are physical parts. (Ibid, 497) He thinks that we can consistently accept these three aspects of objects:

1) There are four-dimensional objects and spatiotemporal parts of such objects.
2) Not every filled region of space-time contains a physical object.

3) Even for a region of space-time that does contain a physical object, not every subregion contains a spatiotemporal part of that object. (Ibid, 497)

His reasoning for (2) depends upon his understanding of what it means for space-time to be filled. A region of space-time might be filled with matter of a certain shape that allows for that region of space-time to be divided into subregions. If the matter is the wrong shape, then there might not be a physical object; yet, the subregion is still filled. In this way, not all space-time would filled with matter, and it would depend on the shape of the matter for there to be physical objects (ibid, 495). He suggests that (3) could be accepted for the same reasons as (2).

The Argument

Heller's argument is against the coincidence of two physical objects. He says that there are five distasteful alternatives that the three-dimensionalist must take in order to avoid the contradiction in the argument. Bear in mind that the three-dimensionalist wants to deny all of these alternatives, as well as have objects persist through time:

a) there is no such physical object as my body,
b) there is no physical object in the space that we would typically say is now exactly occupied by all of me other than my hand,
c) no physical object can undergo a loss of parts,
d) there can be distinct physical objects exactly occupying the same space at the same time,
e) identity is not transitive.

The four-dimensionalist does not have to accept any of these alternatives. Here is a sketch of the argument: There are two spatially different objects, my body ('Body') and all of my body except my hand ('Body-minus'). At some time *t*, I lose my hand.

1) Before-*t* Body-minus = after-*t* Body-minus.
2) Before-*t* Body = after-*t* Body.
3) After-*t* Body = after-*t* Body-minus
4) So, before-*t* Body-minus = before-*t* Body

Before-*t* Body had more parts than before-*t* Body-minus, specifically my hand, which implies that before-*t* Body is not identical to before-*t* Body-minus. Thus, we have a contradiction.

However, if there are four dimensions, then spatially different objects could share a temporal part. Strictly speaking, both Body and Body-minus are not in the same space

at the same time. Only their shared temporal part is filling that region of space-time. The temporal part that the two objects share does not have two objects coinciding in it, it is not being overcrowded by both objects, it is exactly filled by a part of Body and a part of Body-minus that is identical. Heller gives an example of a piece of gold which was shaped into a golden ring (ibid, 499). The ring undergoes a change of matter until it is silver. The gold and the ring overlap, they both share a temporal part; they do not coincide. I think that this raises a question about what boundaries distinguish objects from one another, as well as how those boundaries are formed. The next section will raise such questions of clarification for the four-dimensionalist.

Questions for Clarification

What are the temporal boundaries around an object, and how are those boundaries formed?

Judith Jarvis Thomson brought up an objection to four-dimensionalism by an example of her holding a piece of chalk for an hour. The chalk, she says, has certain physical characteristics such as being white, cylindrical, dusty, and so forth (ibid, 500). Yet, the temporal parts of the chalk comes into and out of existence without any sufficient cause. There is a piece of chalk from time-1 until time-2, another piece of chalk from time-2 until time-3, and so forth. There is no change in matter, no molecules added or subtracted, but a new piece of chalk keeps coming into existence.

Heller sees this critique as founded on the belief that objects are merely three-dimensional, and suggests that the question to be answered is what causes the chalk to have the lower temporal boundary (time-1, etc.) that it does. He thinks that the question of what causes this lower temporal boundary is similar to what causes spatial boundaries. It is a mixture of "... causal mechanisms and material configurations of matter at any given time that affect which parts will exist at the next moment." (Ibid, 501) For Heller, the concept that all sub-regions of an object should contain a temporal part is not built into the theory of temporal parts (ibid, 500). This means that the amount of temporal parts an object has might be less than the amount of sub-regions it has. The piece of chalk might have only one temporal part for the duration of an hour, as there are no causal or material reasons why it should not. Still, the problem of how temporal boundaries are formed has not been solved.

Heller gives us an example of how temporal boundaries might be formed. He says that we tend to think of a person as being one object from birth until death (ibid, 500). It seems natural, however, to distinguish the pre- and post-pubescent parts of the person as being distinct, as it is a change that will have significant ramifications for the person (ibid, 500). This example shows how every subregion of the object that a person fills in space-time does not have to be filled with temporal parts, and that the boundaries of

temporal parts have material and causal origins. Yet the formation of temporal boundaries seems arbitrary, especially if it only selects events that cause enough change to be significant. The argument about Body and Body-minus, from an earlier section, should be reconsidered:

1) Before-*t* Body-minus = after-*t* Body-minus.
2) Before-*t* Body = after-*t* Body.
3) After-*t* Body = after-*t* Body-minus
4) So, before-*t* Body-minus = before-*t* Body

If this argument is reconsidered with both temporal and spatial boundaries in mind, then we might notice that (2) is not true. In losing a hand, Body goes through a significant change in its subregions of space-time. The objects that are Body before-*t* and after-*t* have different spatiotemporal boundaries and do not share a temporal part if it is possible that a new temporal part began when the hand was lost. If they have distinct spatiotemporal boundaries, then they are simply different objects. Heller thinks that (2) is true because the four-dimensionalist is able to accept that physical objects can undergo a loss of parts.[1] That might be the case, but the four-dimensionalist would have to present a thorough account of what makes temporal boundaries. It might be that whatever ends and begins temporal parts of objects is intimately tied to what ends and begins those objects' spatial parts, which would weaken four-dimensionalism's ability to let objects persist through change.

Is it possible for objects to fill new space-time regions?

Another area that requires clarification is the part-to-whole relationship that temporal parts have to the whole object. Either objects are determined and have firm spatiotemporal boundaries, or they are unfolding and have indeterminate spatiotemporal boundaries. Heller's views seem to fall into the former group (ibid, 502). If objects are able to expand and fill other regions of space-time, then it complicates where our spatiotemporal boundaries should begin and end for that object to remain the same object. A human object provides a good example of how this could complicate four-dimensionalism. A human object's spatiotemporal boundaries are continually expanding and diminishing because of causal and material factors.

If a human object eats a pie, then the four-dimensionalist should provide an account for how the pie's region of space-time was affected by the human object. It seems as though the pie's spatiotemporal boundaries were meaningfully altered in such a way that added to the human object's region of space-time. The human object's numerical value of space-time expanded. (I do not have an adequate account of how regions of space-time could be subsumed by other regions of space-time, as it appears to happen

when the human object interacts with the pie. That is something that the four-dimensionalist should also provide an answer for.)

Because a human object's spatiotemporal boundaries are continually expanding and diminishing, we ought to consider what it is for an object to be a distinct object. Spatiotemporal boundaries only seem to be able to hold an object if those boundaries are determined and firm. If an object can expand and diminish its boundaries, however, then we should consider what would be required for an object to persist despite change.

Essential Part

I am tempted to accept an ontology with temporal parts, but it seems to me that there is something lacking if objects are only defined by their spatiotemporal boundaries. These boundaries are, if what we have seen is correct, changeable and without an account of why those boundaries ought to constitute that object. If a region of space-time is able to change its spatiotemporal boundaries, then it seems that that object changes with it. Body and Body-minus are an example of this. Heller thinks that they are two objects that share a temporal part, but I suggested above that the temporal part is divided exactly where they would share it. This means that the subregion of space-time that that temporal part is supposed to fill is divided further into two sub-subregions that are spatiotemporally distinct. If this is true, then Body and Body-minus are distinct spatiotemporal objects. It would mean that Body did not survive a change of its parts.

This seems problematic, however, as we want to think that objects can persist despite a change of their parts. In this section I will accept four-dimensionalism and modify it to include a subregion of space-time that constitutes the object to be an essential part of that object that, if lost, would result in the object no longer existing. This will allow for the boundaries of objects to be expanded or diminished, as well allow for objects to persist through time so long as their essential part has not been changed. When an essential part is changed, however, perhaps in a circumstance like puberty, the essential part might be changed. My hope is that the following account of essential parts will be a useful tool in deciding the boundaries of spatiotemporal parts, which will show us when spatiotemporal parts begin and end.

An essential part is the part that an object cannot lose, or do without, without either ceasing to exist or being reshaped into a different object. There is a distinction to be made between animated objects and inanimate objects. An example of an animated object is a human; an example of an inanimate object is a pie. Inanimate objects have no essential part, as they are regions of space-time with specific shapes. They can lose these shapes, and the matter than fills the region of space-time could form a new, different shape. This forms a new object. These regions of space-time require causal and material factors in order to be reshaped. They are the same shape of space-time so

long as their spatiotemporal parts are not altered or reshaped, and so do not persist through change, but also do not randomly come in and out of existence.

Animated objects, such as humans, have an essential part that, if altered or lost, alters or takes the animated object out of existence as that specific animated object. The part that animates is the essential part, such as consciousness or rationality. This is the self, the ego, the *I* that is the thing that can think, and so on. My goal here is not to define the essential part, but only to assert that we have one in order to suggest a possible way that the four-dimensionalists might be able to get away from the problem of spatiotemporal boundaries[2]. I would like to divorce the essential part from spatial and temporal parts, as it provides better explanatory power. If the four-dimensionalist will accept the essential part, then that is the part that is shared by both Body and Body-minus. They would be two spatiotemporal parts of one object with an essential part. They would not have a shared temporal part, though they would have some shared spatial parts.

Conclusion

We began by looking at Mark Heller's fourth-dimensionalism as a way for objects to persists through change without having to accept some distasteful alternatives. We discussed how the changing of spatial and temporal boundaries might be intimately connected, so as to end and begin temporal parts alongside their object's spatial parts and make persistence through time for that object impossible. This led us to describe an essential part that would be required for an object to persist through change despite losing or gaining spatiotemporal parts. The three-dimensionalist could also include an essential part in their ontology in an effort to explain persisting through change, but I think that it would be an error to do without temporal parts. Without temporal parts, inanimate objects would have nothing that holds them together as the same inanimate object throughout time. I also suspect that the essential part of animate objects, since it is the part that animates the object, could interact with the spatial and temporal parts in different circumstances, or even continuously, in order be animate.

Works Cited

Heller, Mark. "Temporal Parts of Four-Dimensional Objects." In *Metaphysics: An Anthology*, 2nd edition. Edited by Jaegwon Kim, Daniel Z. Korman, and Ernest Sosa. New York: Blackwell, 2012. Pages 492-503.

[1] 'c) no physical object can undergo a loss of parts' from above, one of the five alternatives the three-dimensionalist must accept.

[2] What the essential part is should be answered by both scientists and philosophers.